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Effect of using Compound Feeds with Different Protein Levels on Meat-type Quails

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ABSTRACT

Background: In raising quails for meat production, great importance must be given to their nutrition, the use of the right compound feed suitable for them ensuring the achievement of higher performance. The aim of the research was to establish the influence of crude protein in compound feed on production performance in meat-type quails and their productive characterization.

Methods: For the research, data were collected and statistically processed from Jumbo meat quails, youth and adults, during the years 2020 and 2021 in a farm specialized in quail growth.

Result: It is recommended to use in the meat quail youth a compound feed with a protein value of 24.80% throughout the six weeks of growth because it ensures 15.00% superior performance (265.23±4.13 g/head at 42 days) compared to the reduction of the protein level at the age of 21 days from 24.80% to 22.50%. It is also recommended for laying quails to use a feed with a protein level of 21% which leads to significantly higher results (average 12-month laying percentage of 78.75±2.91%) compared to protein level of 18.20%.

Key words: Compound feed, Crude protein, Jumbo meat quail, Productive performances.

INTRODUCTION

Quails are of particular importance both due to the production of eggs, meat, scientific and medical research (Bai *et al*., 2020; Kaplan *et al*., 2018; Taskin, 2017).

Quail can be exploited for meat production due to their short incubation period (Azahar *et al*., 2018), short periods of growth and maturation of the youth (Monika *et al*., 2020; Redoy *et al*., 2017) and the good laying in the first eight months period (Jatoi *et al*. 2013).

The consistent progress registered in bird nutrition is one of the key factors of recent development in the poultry industry (Sirsat *et al*., 2018). Most poultry nutrition research looks at protein, because the level of protein is the most important factor in the final cost of the compound feed Hertamawati *et al*., (2019) mention that protein and energy account for 85% of the final cost of compound feed). From the 20 amino acids that make up the protein structure, methionine and lysine levels are critically important in the composition of compound feed recipes for poultry growth (Melaku *et al*., 2019). In growing quails, the level of protein, mainly methionine and lysine, varies considerably in relation to the growth rate of chicks and the level of egg production in adult quails. The higher the growth performance of chicks and the production of adult quails, the higher the protein requirements (Garcia *et al*., 2019).

The aim of the research was to establish the influence of the protein level of the compound feed on the breeding performance of young and laying quails and the production performance of brown Jumbo meat quails throughout the production cycle.

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MATERIALS AND METHODS

Location

The experiments were carried out between March 2020 and June 2021, in the Department of Animal Husbandry Technologies, Animal Productions Engineering and Management Faculty from the University of Agronomic Sciences and Veterinary Medicine of Bucharest and in the quail breeding farm “Ionita T Lucian Individual Enterprise”.

Experimental design and feeding

The research works were carried out on 630 Jumbo brown meat quails (Table 1), randomly divided in two equal groups since hatching (group A_1, that received two types of

combined feed with different protein levels, corresponding to the two growth phases, namely the 1-3 week phase (24.80% crude protein, CP) and the 4-7 week growth phase (22.50% CP) and group A_2, which received a single type of combined feed with a protein level of 24.80% CP throughout the 1-7 week period of growth. For determination the carcass characteristics, were analysed at 7-week-old males from the groups A_1 and A_2, identified in the experiment as forming groups A_{1-1} and A_{2-1}. Also, at the age of 7 weeks, 300 adult quails (females) obtained were divided into two equal groups (group A_{1-2}, that received combined feed with a protein level of 18.20% CP and group A_{2-2}, that received combined feed with a protein level of 21.00 % CP).

On the basis of chemical analysis of the raw materials, their nutritive values were calculated and compound feed recipes were formulated and manufactured by growth phase and treatment. The nutritional values of the compound feed recipes used in the experiment and their ingredients are shown in Table 2.

The animals in the experiment were cared for in accordance with Law 43/2014 for the handling and protection of animals used for experimental purposes and EU Council Directive 98/58/EC on the protection of farm animals, approved by our university. Livestock was uniform in terms of body weight and the experimental block design was used.

Analytical measurements and statistical analysis

Growth performances in youth quail

At the age of one day and then weekly up to 42 days inclusively, live weight and daily consumption of compound feeds were determined; then by their statistical processing, data were obtained on the average daily weight gain and specific consumption of compound feeds.

Carcass yield

The quails weighing (g) before slaughter, of the eviscerated carcases and of the breast were done; then by processing this data yields at slaughter (%) were obtained.

Productive performances in laying quail

The daily number of eggs and the daily consumption of compound feeds (g) were registered. Then, by statistical processing of these data, the average percentage of laying, egg production/head/month and specific consumption per egg were obtained. Also, were determined data on the weight of the quails and of the eggs on each month.

Statistical analysis

The results were presented as mean values±standard errors of the mean. The Microsoft Excel 2016 program to calculate the statistical parameters and the Student test to establish the significance of the differences between the means (Sandu 1995) were used. The differences between the analysed means were non-significant (at $P>0.05$), significant ($P\leq0.05$), distinctly significant ($P\leq0.010$) or very significant ($P\leq0.001$) and indicated by superscripts.

RESULTS AND DISCUSSION

The evolution of the growth performances in the young meat quails groups during 1 to 6 weeks of age

In the first three weeks, the differences between the averages of the analysed performances were insignificant (Table 3, Table 4). Between 28-42 days, the differences become significant between the two groups. Thus, the live weight at the age of 28 days in group A_2 was 180.44±3.55 g/head, with 16.13% higher compared to A_1 and the weekly growth gain was 49.89±2.06 g/head in A_2 and of 25.59±0.34 g in group A_1.

The live weight at the age of 35 days in group A_2 was 226.45±3.89 g/head, with 15.98% higher compared to A_1 and the weekly growth rate 46.01±2.23 g/head in A_2 and 38.94±0.65 g in A_1.

Live weight at the age of 42 days in group A_2 was 265.23±4.13 g/head, with 15.00% higher compared to A_1 (225.46±4.04 g/head) and weekly growth rate 38.78±1.78 g/head in A_2 and of 35.19±1.06 g/head in A_1.

Two experiments conducted in India by Malarmathi *et al.* (2012) and Umamaheshwari *et al.* (2018), with crude protein of 24% during 0-3 weeks and 21.10% during 4-5 weeks on a flock of Japanese meat quails mentioned body weights at 2, 4 and 5 weeks similar with those obtained in group A_1.

Two Jumbo meat quail experiments performed in South Africa by Mbhele *et al.* (2019), Marareni and Mnisi (2020) reported growth performances similar to those recorded in group A_1.

In period 28-42 days of the present experiment, as in the case of body weight and growth gain, the differences in feed consumption and specific consumption are significant between the two groups. Thus, in the 5th week of growth, the average consumption of compound feeds was 21.34±0.87 g in group A_2, with 24.34% lower compared to A_1. The specific consumption was 3.25±0.59 in group A_2 and 5.07±0.68 in A_1. In the sixth week of growth the average consumption was 29.76±2.56 g in group A_2, with 18.35% lower compared to A_1. The specific consumption was 7.25±0.55 in group A_2 and of 5.37±0.12 g c.f. /g gain in A_1, the difference between the two groups being very significant.

In an experiment on a flock of meat quail youth, in Romania, Stoica and Stoica (2001) mention a compound feed consumption and a specific consumption in week 5 of

Table 1: Experimental design scheme for the age of the birds and the type of compound feed administered.

Age and recipe of compound feed administered	
Group A_1	
0-3 weeks- recipe I	Group A_{1-1}- males 7 weeks- recipe II
4-6 weeks- recipe II	Group A_{1-2}- laying females- recipe III
Group A_2	
0-6 weeks- recipe I	Group A_{2-1}- males 7 weeks- recipe I
	Group A_{2-2}- laying females- recipe IV

Table 2: The nutritional values of the compound feed recipes used in the experiment and their ingredients*.

Nutritional parameters	Recipe I	Recipe II	Recipe III	Recipe IV
Metabolizable Energy (kcal/kg c. feed)	3010	3140	2800	2720
Crude Protein (%)	24.80	22.50	18.20	21.00
Methionine (%)	0.59	0.64	0.38	0.56
Lysine (%)	1.58	1.33	0.78	1.14
Calcium (%)	0.96	0.96	3.12	3.24
Phosphorus (%)	0.78	0.75	0.67	0.66
Ingredients	Cereals, soybean meal, corn gluten, calcium phosphate, calcium carbonate, salt, amino acids, vitamin premix, antioxidant (Etoxichin, BHT, BHA).(www.ibna.ro)			Corn, soybean meal, sunflower meal, calcium carbonate, mineral vitamin premix, monocalcium phosphate, salt (www.agromar.ro)

Note: According to NRC (1994): Nutrient Requirements of Poultry, National Research Council, National Academy Press, Washington D.C, 9th Revised Edition, pp 234.

Table 3: The evolution of body weight in the Jumbo meat quail youth from the two groups during the period 1-42 days of growth.

Age (days)	Average body weight (g/head) $\bar{X}\pm s\bar{x}$	
	Group A_1	Group A_2
1 day	9.35±0.67NS	9.45±0.65NS
7 days	29.30±1.67NS	31.24±1.87NS
14 days	55.76±2.44NS	58.35±2.67NS
21 days	125.74±3.56NS	130.55±3.05NS
28 days	151.33±3.23***	180.44±3.55***
35 days	190.27±3.45***	226.45±3.89***
42 days	225.46±4.04***	265.23±4.13***

Note: NS-Non significant at P>0.05; *** - Very significant at P≤0.001.

growth, closed to those obtained in the present experiment in group A_2.

Carcass characteristics in 7 week-old males Jumbo quail in groups A_{1-1} and A_{2-1}

The average carcass weight measured at seven weeks of age was with 22.12% higher in group A_{2-1} (212.68±4.54 g) compared to group A_{1-1} (165.63±3.67 g) (Table 5). The final yield of the carcass at seven weeks was with 4.11% higher in group A_{2-1} (74.46±3.64%) compared to group A_{1-1}. The average breast weight was with 21.29% higher in A_{2-1} (102.87±4.56 g/carcass) compared to group A_{1-1}.

The differences between the average carcass characteristics of the two analysed lots were very significant.

A study conducted in Turkey by Ozbey *et al.* (2004) mentions carcass characteristics similar to those recorded in group A_{1-1}.

The evolution of the production performances at laying Jumbo meat quails during the period 1-12 months of laying

The peak of laying (Table 6) in both groups of the analysed quails was recorded in the sixth month, being very significantly higher, with 16.00%, in group A_{2-2} (92 .00±2.56%) compared to group A_{1-2}. Also, there was the highest egg production /head in both groups.

The laying percentage remained above 80% between the fourth and ninth months in the case of the group A_{2-2} and above the level of 70% between the third and the ninth month in group A_{1-2}.

The average laying percentage in the period 1-12 months (Table 6) was of 67.33±2.83% in group A_{1-2} and by 11.42 % higher in A_{2-2} group.

Body weight (Table 7) registered an ascending trend during the 12 months of the study (from 230.00±2.54 g/head in group A_{1-2} and 280.00±3.05 g/head in A_{2-2} in the first month, to 287.00±5.23 g/ head in group A_{1-2} and to 351.00±6.76 g/ head in A_{2-2} the 12th month).

The average weight of the egg, very significantly higher in group A_{2-2}, increased until the sixth laying month in both groups**.** It remained at a high level until the ninth month, then gradually decreased until the twelfth (10.15±0.67 g/ egg in group A_{1-2} and 11.95±0.22 g/ egg in A_{2-2}).

The average specific consumption had the same curve as the percentage of laying, with a minimum in the sixth month in both groups (54.55±4.05 g c.f./egg in group A_{1-2} and 41.17±3.23 in A_{2-2}).

The differences between the averages of the production performances of the two analysed groups were very significant in all laying months.

A study conducted in Brazil by Santos *et. al.* (2015) mentions to a flock of meat quail called “European”, at 4 months of laying an average of 91.94%, higher than in both groups from this paper. The weight of the egg was of 12.73 g, similar to that in the present experiment in group A_{2-2}. It should be mentioned that the levels of crude protein and lysine were of 20%, 1.05% respectively.

In a study conducted in Cameroon by Francois *et al.* (2021), on several quail varieties of quails, had found in the brown variety that the laying peak was in the sixth month (74%, similar in value to that in the group A_{1-2}).

In nutrition experiment conducted in Sudan on Japanese brown laying quails for 10 weeks, Muhammad *et. al.* (2016) concluded that increasing protein levels of compound feed leads to increased production performances.

In an experiment performed in Brazil on quails in the 12th month of laying, Souza *et al.* (2016) obtained higher values in number and weight of eggs compared to the groups analysed in the present experiment.

Stoica and Stoica (2001) mention that the level of lysine influences the mass of the yolk and the level of methionine the mass of the white, so that the deficiency of them is reflected by the corresponding decrease in the weight of the eggs, similar to that in the present experiment in group A_{1-2}.

Table 4: The evolution of the gain growth, compound feeds consumption and specific consumption of quail youth from the two analysed groups.

Age (weeks)	Weight gain (g)		Compound feeds consumption (g/day)		Specific consumption (g c.f./g gain)	
	$\bar{X}\pm s\bar{x}$					
	Group A_1	Group A_2	Group A_1	Group A_2	Group A_1	Group A_2
I	19.95±1.87NS	21.79±1.05NS	5.67±0.11NS	6.12±0.98NS	1.99±0.33NS	1.97±0.16NS
II	26.46±2.55NS	27.11±2.16NS	12.34±0.15NS	12.87±1.67NS	3.26±0.13NS	3.32±0.90NS
III	69.98±2.05NS	72.20±3.55NS	18.33±0.87NS	18.56±1.98NS	1.83±0.25NS	1.80±0.34NS
IV	25.59±0.34***	49.89±2.06***	21.43±1.87*	19.43±1.05*	5.86±0.89***	2.73±0.67***
V	38.94±0.65**	46.01±2.23**	28.22±1.45***	21.34±0.87***	5.07±0.68***	3.25±0.59***
VI	25.19±1.06***	38.78±1.78***	36.45±1.43***	29.76±2.56***	7.25±0.55***	5.37±0.12***
Average I-VI	36.02±7.30***	42.63±7.37***	20.41±4.49**	18.01±3.26**	4.21±0.89***	3.07±0.53***
Total I-VI	216.11	255.78	857.22	756.42	-	-

Notes: NS-Non significant at P>0.05; * - Significant at P≤0.05; ** - Distinct significant at P≤0.010; *** - Very significant at P≤0.001.

Table 5: Carcass characteristics in Jumbo quail males in groups A1-1 and A2-1 at 7 weeks of age.

Specification	Group A_{1-1}	Group A_{2-1}
	$\bar{X}\pm s\bar{x}$	
Average body weight (g)	235.44±5.08***	285.63±6.56***
Eviscerated carcass weight (g)	165.63±3.67***	212.68±4.54***
Carcass yield (%)	70.35±3.54***	74.46±3.64***
Average weight of breast (g)	81.58±3.97***	102.87±4.56***

Note: *** - very significant (P≤0.001).

Table 6: Evolution of egg production and egg weight in laying Jumbo meat-quails from the two batches during 1-12 months of laying.

Laying month	Average laying percent (%)		Average egg production (eggs/head/month)		Average egg weight (g/egg)	
	Group A_{1-2}	Group A_{2-2}	Group A_{1-2}	Group A_{2-2}	Group A_{1-2}	Group A_{2-2}
I	40.00 ±0.87***	55.00±1.07***	12.00±0.67***	16.50±0.84***	8.90±0.65***	9.50±0.23***
II	62.00±1.55***	75.00±2.16***	18.60±0.87***	22.50±1.09***	10.20±0.23***	11.30±0.45***
III	71 .00±2.33***	78.00±1.98***	21.30±1.04***	23.40±1.45***	11.30±0.34 ***	12.80±0.65***
IV	73.00±2.76***	80 .00±2.26***	21.90±0.63***	24.00±1.56***	12.25±0.56***	13.23±0.45***
V	75 .00±2.65***	90.00±2.78***	22.50±1.05***	27.00±0.95***	12.85±0.78***	13.50±0.33***
VI	76.00±3.16***	92.00±2.56***	22.80±0.43***	27.60±0.76***	12.65±0.56***	13.15±0.34***
VII	73.00±2.23***	88.00±3.03***	21.90±0.83***	26.40±1.05***	11.75±0.34***	12.85±0.88***
VIII	72.00±1.89***	85.00±3.32***	21.60±0.79***	25.50±1.23***	11.25±0.76***	12.75±1.05***
IX	71.00±2.05***	81.00±2.56***	21.30±0.76***	24.30±0.76***	11.15±0.89***	12.34±0.79***
X	68.00±2.97***	77.00±3.78***	20.40±0.92***	23.10±0.73***	10.70±0.23***	12.05±0.18***
XI	65.00±3.45***	74.00±3.23***	19.50±1.06***	22.20±0.34***	10.55±0.16***	12.00±0.34***
XII	62.00±2.12***	70.00±3.06***	18.60±1.16***	21.00±0.98***	10.15±0.67***	11.95±0.22***
Average	67.33±2.83***	78.75±2.91***	20.20±0.85***	23.63±0.87***	11.42±0.33***	12.29±0.31***

Notes: *** - very significant at P≤0.001.

Table 7: Evolution consumption of compound feeds, specific consumption for egg and of the body weight in Jumbo laying quails from the two groups during 1-12 months of laying.

Laying month	Average consumption of compound feeds (g/head/day)		Specific consumption of compound feeds (g c.f./egg)		Body weight (g/head)	
	Group A_{1-2}	Group A_{2-2}	Group A_{1-2}	Group A_{2-2}	Group A_{1-2}	Group A_{2-2}
I	37.35±0.56*	34.55±0.22*	93.38±2.11***	62.82±3.03***	230.00±2.54***	280.00±3.05***
II	38.25±0.67*	35.67±0.54*	61.69±1.87***	47.56±2.65***	245.00±3.68***	285.00±5.13***
III	39.75±0.98**	36.22±0.76**	55.99±2.56 ***	46.44±2.44***	260.00±4.65***	305.00±4.99***
IV	40.25±1.34**	36.91±0.44**	55.14±3.44***	46.14±1.78***	275.00±3.78***	315.00±6.00***
V	41.35±1.07***	37.23±0.32***	55.13±3.22***	41.37±2.68***	277.00±5.02***	325.00±6.13***
VI	41.45±0.67***	37.88±1.06***	54.54±4.05 ***	41.17±3.23***	280.00±5.05***	327.00±5.34***
VII	42.75±0.76**	38.25±0.93**	58.56±3.11***	43.44±3.44**"	275.00±5.16***	330.00±4.67***
VIII	43.36±0.89***	38.37±1.05***	68.22±2.22***	45.14±2.07***	277.00±3.90***	335.00±3.45***
IX	44.27±1.23***	38.54±0.78***	62.35±3.55***	47.58±3.89***	280.00±5.15***	340.00±6.03***
X	44.38 ±c 0.78***	38.62±0.44***	65.26±2.15***	50.16±3.05***	283.00±4.34***	345.00±4.34***
XI	44.67±0.75***	39.00±0.87***	68.72±2.67***	52.70±3.23***	285.00±4.90***	347.00±5.87***
XII	45.34±0.65***	39.44±0.33***	73.13±3.34***	56.34±1.08***	287.00±523***	351.00±6.76***
Average	41.93±0.76***	37.56±0.43***	63.68±3.18***	48.41±1.82***	271.17±5.03***	323.75±6.75***

Note: * - Significant at P≤0.05; ** - Distinct significant at P≤0.010; *** - Very significant at P≤0.001.

CONCLUSION

The present research showed that the use at young meat quails, in the second part of the growth (period 4-7 weeks), of a combined feed with a higher protein level had superior results both on the growth of chicks and on the yield at slaughter. Also, the use of a compound feed with a higher protein level in adult meat quails led to superior results both on production performance and the consumption of compound feed throughout the exploitation period (1-12 months of laying. It is recommend that the combined feeds for meat quails to be very well balanced nutritionally, but also optimized from economic point of view, depending on the specific consumption of combined feeds on growth gain mass, in the case of youth and on the egg in the case of adult quails.

Conflict of interest: None.

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